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A drive unit with a retarder

The invention relates to a drive unit, in detail with the features of the preamble of claim 1.

A retarder is frequently integrated as a means of reducing speed or rotational speed in drive units of vehicles or stationary units. The retarder is activated or deactivated during the use in the motor vehicle or units with strongly varying operation by filling or emptying the blade-actuated working circulation with an operating fluid.

The stationary or mobile units (such as motor vehicles) in which the said drive units are installed usually have further units which require cooling. Examples are engines, brakes, clutches, transmissions, etc.

These other units can also be provided with a cooling circuit in order to cool their working medium.

Retarders have become known from a large number of patents where the working medium of the retarder is the cooling medium of the vehicle. Reference is hereby made to

EP 0 716 966 A1;
WO 98/15725;
EP 0 885 351 B1;
EP 0 932 539 B1.

The disadvantageous aspect in these retarders as known from these publications is their high power loss in non-braking operation.

The document US-A-3 924 713, which is regarded as representative for the closest state of the art, shows a retarder, which is provided with a device for sucking off the gaseous volume from the interior of the working chamber, so that the retarder might be filled more rapidly and a desired breaking torque might be reached more rapidly. The features known from this document are summarized in the preamble of claim 1.

It is the object of the present invention to minimize power loss in drive units with such retarders.

This object is achieved by a drive unit with the features of claim 1. A cylinder for sucking off a residual fluid quantity of the working medium in non-braking operation is used in a special embodiment of the invention.

The power loss can be minimized even further when the rotor and/or the stator are provided with an axially displaceable configuration, so that a large gap is formed between the rotor and stator in non-braking operation. Such a solution has been described for an oil-operated retarder in WO 98/35171. The scope of disclosure of this publication is fully included in the present application.

Further advantageous embodiments of the invention are the subject matter of the sub-claims.

The invention is now described in closer detail by reference to the drawings, wherein:

Fig. 1 shows a first embodiment of the invention;

Figs. 2 and 3 show a second embodiment of the invention;

Fig. 4 shows a third embodiment of the invention.

Fig. 1 shows a secondary retarder 100 which is operated with the cooling medium of the vehicle. Heat is dissipated from the cooling medium by means of the vehicle radiator 3 and, optionally, the fan 4. The thermostat determines the amount of cooling medium which is guided through the radiator 3 and the amount which is guided past the same. The retarder shown in fig. 1 is characterized by a low power loss.

Claims:

1. A drive unit, especially of a vehicle, with a cooling circuit, comprising:

1.1 a hydrodynamic retarder (100) with a rotor blade wheel (11) and a stator blade wheel (12), with

1.2 the hydrodynamic retarder (100) being arranged in the cooling circuit and the working medium of the retarder being the cooling medium, characterized in that

1.3 the retarder (100) comprises means for discharging a residual amount of liquid against the external pressure built up by the cooling system in a non-braking operation.

2. The drive unit according to claim 1, characterized in that the means for discharging are means for sucking off the residual amount of liquid from the retarder.

3. The drive unit according to claim 1 or 2, characterized in that the means for discharging comprise at least one cylinder (30, 40) which is connected to the cooling circuit (120) and/or the retarder (100) via lines (32, 33, 41, 42).

4. The drive unit according to one of the claims 1 to 3, characterized in that the cylinder (30, 40) is connected via a line (32, 42) to the point of highest pressure in the cooling system (120).

5. The drive unit according to one of the claims 1 to 4, characterized in that a throttle (43), especially a controllable throttle, is arranged in the line (32, 42) from the cylinder (30, 40) to the point of highest pressure.

6 The drive unit according to one of the claims 1 to 3, characterized in that the means for discharging further comprises a switchable valve (31).

7. The drive unit according to one of the claims 1 to 6, characterized in that the cylinder is connected via a line (41) to the cooling circuit (29) at the point of lowest pressure in the cooling circuit.

8. The drive unit according to claims 7 and 4, characterized in that the line (42) which is connected to the point of highest pressure in the cooling system (120) and the line (41) which is connected to the point of lowest pressure in the cooling circuit (29) are connected at opposite sides of a piston (37) to the cylinder (40), and that the piston (37) is pressurized by a pressure spring (36) which presses the piston (37) against the pressure supplied through line (41).

9. The drive unit according to one of the claims 1 to 7, characterized in that a pressure relief line (64, 65) with a pressure cut-off valve (62) is connected to the cooling circuit (29) and/or the retarder (100), with the pressure cut-off valve (62) being inserted into the pressure relief line (64, 65) and controlled in such a way that it will open during the transition of the retarder from the braking operation to the non-braking operation.

10. The drive unit according to claim 9, characterized in that one end of the pressure relief line (64, 65) is connected to a point of low pressure in advance of the retarder (100) as seen in flow direction during the braking operation, and in that the other end is connected to a point of high pressure at or behind the retarder (100), whereby the pressure at the point of low pressure is especially maximum 2 bar, and the pressure at the point of high pressure is especially between 11 bar und 30 bar.

11. The drive unit according to one of the claims 1 to 10, characterized in that the drive unit comprises an engine (1) and a transmission, and the retarder (100) is a secondary retarder which is arranged behind the transmission as seen in the direction of force flow.

12. The drive unit according to one of claims 1 to 11, characterized in that the means for discharging a residual amount of liquid comprises a cylinder (40) having a piston (37) which is pressurized by a first high pressure on one side via a line (42) connected to a point of high pressure in the retarder module in the cooling circuit behind the retarder (100) as seen in flow direction, and which is pressurized by a second low pressure on its opposite side via a line (41) connected to a point of low pressure in the retarder module in the cooling circuit in advance of the retarder (100) as seen in flow direction.

13. The drive unit according to claim 12, characterized in that a throttle (43) is provided in the line (42).

14. The drive unit according to one of claims 11 to 13, characterized in that the retarder module further comprises a pressure cut-off valve (62) in a pressure relief line (64, 65), one end of the pressure relief line (64, 65) being connected to a point of high pressure at or behind the retarder (100) as seen in flow direction, and the other end being connected to a point of low pressure of the cooling circuit in advance of the retarder (100) as seen in flow direction.

15. The drive unit according to claims 13 and 14, characterized in that the end of the line (42) opposite to the cylinder (40) is connected to a control valve (17), and in that the drive unit further comprises a switch-over valve (13) behind a connection (71) for supplying cooling medium into the retarder and in advance of the retarder (100) as

seen in flow direction, which is configured such that in predetermined switching positions it directs cooling medium through the retarder (100) or around the retarder through a bypass (66), and in that the control valve (17), the cut-off valve (61), and the switch-over valve (13) are switched or controlled by means of pressurization.

16. The drive unit according to one of the claims 11 to 15, characterized in that the retarder (100) has a single connection (71) for supplying with cooling medium, and a single connection (72) for discharging cooling medium.

17. The drive unit according to claims 15 or 16, characterized in that the control valve (17) and the switch-over valve (13) are completely sealed in the direction of the retarder, as switched in the predetermined switching positions in which the cooling medium is directed through the by-pass (66) around the retarder.